

Glenn Research Center
Restore Vacuum Facility VF-7

293.601.1.1

P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7PT4	Pressure Transmitter	Rosemount	2088G2S22A1			4-20 ma
SHT 3 OF 7	7PT5						0-150 psig
							316 SS
							Silicone diaphragm isolation fluid
							1/2"-14 FPT
							1/2"-14 conduit
							Non-explosion proof
							See catalog cut for mounting options

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	AS7000	Brass Ball Valve	Worcester	1/2" 44 11TSE	1/2"	1000 psig	Brass
SHT 3 OF 7	AS7004						Female NPT Ports
	AS7007						Non-Vented
							Lever Handle
							Use Parker 12-8 FBZ 1/2" male NPT to 3/4"
							tube adapters

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 3 OF 7	AS7010	Brass Ball Valve		6Z-B6LJ-BP	3/8"	1500	3/8" Parker CPI Tubing Connections Brass 1/4 Turn Instrument Ball Valve
	AS7011						
	AS7015						
	AS7016						
	AS7017						
	AS7018						
	AS7019						
	AS7020						
	AS7021						
	AS7022						
	AS7023						
	AS7031						
	AS7032						
	AS7033						
	AS7034						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	AS7005	Pressure Gage	WIKA	111.10	4"		0-200 psig
SHT 3 OF 7	AS7008						Copper alloy wetted parts
	AS7012						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	AS7001	Filter	Parker	07F38AC	1/2"		90 SCFM @ 100 psig
SHT 3 OF 7							Substitutions acceptable with written approval. 1/2" FNPT Ports Use Parker 12-8 FBZ adapters 40 micron element Autodrain Metal bowl with sight glass

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 3 OF 7	AS7002	Regulator	Parker	07R318AC	1/2"	125 psig	90 SCFM @ 100 psig 1/2" FNPT ports Use Parker 12-8 FBZ adapters Includes 160 psig Pressure Gage Combination Filter-Regulator is acceptable as replacement for AS7002 and AS7001, Parker 07E-38-A18C or approved equal.

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 3 OF 7	AS7003	Oiler	Parker	17L34BE	1/2"		90 SCFM @ 100 psig Metal bowl, sight gage Fill plug 1/2" FNPT ports Use Parker 12-8 FBZ adapters

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 3 OF 7	AS7006	Relief Valve	Circle Seal	D559B-4M-125	1/2"		Set at 125 psig Popoff valve with deflector cap 1/2" MNPT, use Parker 12-8 GBZ adapter 95 SCFM of air at 10% over setpoint

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	WS7000	Ball Valve	Worcester	1-1/2" 44 11TSE	1-1/2"	1000	Swing out design
SHT 4 OF 7	WS7020						Brass construction
	WR7000						Use Parker 24-24 FBZ 1-1/2" MNPT to 1-1/2"
	WR7025						Tube adapters

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	WR7001	Globe Valve	Milwaukee	590T	3/4"	150	Threaded end commercial bronze glove valve
SHT 4 OF 7	WR7002						Alternate valves acceptable with written approval by NASA
	WR7003						Install unions as required to facilitate assembly and servicing of valves
	WR7004						\$26.95
	WR7005						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 4 OF 7	WS7001	Ball Valve	Worcester	3/4" 44 11T SE	3/4"	600	Swing out design Brass construction
	WS7003						
	WS7005						
	WS7007						
	WS7009						
	WS7011						
	WS7021						
	WS7023						
	WS7025						
	WS7027						
	WR7006						
	WR7020						
	WR7021						
	WR7022						
	WR7023						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 4 OF 7	WS7002	Thermal Relief Valve	Circle Seal	D562B-6M-100	3/4"		Thermal expansion relief, 100 psig setpoint
	WS7004			D562B-6M-100			Thermal expansion relief, 100 psig setpoint
	WS7006			D562B-6M-100			Thermal expansion relief, 100 psig setpoint
	WS7008			D562B-6M-100			Thermal expansion relief, 100 psig setpoint
	WS7010			D562B-6M-100			Thermal expansion relief, 100 psig setpoint
	WS7022			D562B-6M-35			Thermal expansion relief, 35 psig setpoint
	WS7024			D562B-6M-35			Thermal expansion relief, 35 psig setpoint
	WS7026			D562B-6M-35			Thermal expansion relief, 35 psig setpoint

Note that Ethylene Propylene seals have been specified to resist ozone exposure!

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	WS7012	Pressure Gage	WIKA		4"		Match MOC of line
SHT 4 0F 7	WS7028						
	WR7007						
	WR7024						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	7TC23	RP1 CR	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
		BL1 CR	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
SHT 4 OF 7	7TC24	BL2 CR	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC25			SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC26	ODP Cooling Water Return	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC27	ODP Cooling Water Return	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC29	ODP Cooling Water Return	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC30	ODP Cooling Water Return	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC31	ODP Cooling Water Return	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	WS7030	Pressure Reducing Regulator	Cashco	DL	1-1/2"	150	Bronze
SHT 4 0F 7							Set to 30 psig supply pressure to Rm 146 equipment \$818

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231 SHT 5 OF 7	GN7008	Needle Valve	Parker	4V-NMLBN-SS-V	1/4" Tube	1500 psig	Metering Valve, 1 LPM SS \$135.00

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7009	Relief Valve	Parker- Republic	480/490	Size 10		1 psig , Cv=6
SHT 5 0F 7	GN7026						Brass \$33

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7006	Relief Valve	Circle Seal	500-8M	1"	3000	1- psig, 115 SCFM air
SHT 5 OF 7	GN7023						\$216 500-8M SS

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7007	Solenoid Valve	ASCO	8262G90VM	1/4"	27 psid max	NC (1/4" pipe, Medium. Vacuum Rated)
SHT 5 OF 7	GN7031						\$104 Brass

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7PT6	Pressure Transmitter	Rosemount	2088G1S22A1			4-20 ma
SHT 5 OF 7	7PT7						0-30 psig 316 SS Silicone diaphragm isolation fluid 1/2"-14 FPT 1/2"-14 conduit Non-explosion proof See catalog cut for mounting options

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7003	Regulators	Parker-Watts Fluid Air	Watts R119-02-A	1/4"		NASA specified for vacuum resistance
SHT 5 0F 7	GN7021						\$48 Zinc Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7030	Flow Meter	DWYER	RMA-5	0-10 SCFH	100 psig	with integral needle valve
SHT 5 OF 7							Polycarbonate \$21 Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7012	Air Operated Valve	ASCO	F262C90K (Cv= 0.96)	1/2"	100 psig	Note ASCO valves only have NPT fittings. 3/8" closes to tubing size
SHT 5 0F 7							Brass \$127 3-4 weeks delivery

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7011	Pneumatic Relay	Parker-Moore	67R-100	1/2"	100 psig	Reverse acting precision pneumatic relay
SHT 5 OF 7							Brass \$242 3-4 weeks delivery

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7013	Soleoid Valve	ASCO	8210G33VM	1/2"	100 psig	NO (3/8" pipe, Medium Vacuum Rated)
SHT 5 OF 7							Brass \$279 Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7001	Pressure Gage	Wika	233.53	1/4" NPT		180-200 psig service. 0-400 psig range
SHT 5 OF 7							4" dial, liquid filled SS \$50 Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7004	Pressure Gage	Wika	111.1	1/4" NPT		Compound. 2.5", liquid filled
SHT 5 0F 7	GN7022			-30" Hg - 30 psig			SS
	GN7025						\$50
							Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7002	Ball Valve w/ PTFE Trim	Parker	4Z-B6L J SS	1/4" Tube		Standard Parker Instrument Ball Valve
SHT 5 OF 7							SS w/ PTFE seats \$75.00 Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7020	Ball Valve w/ PTFE Trim	Parker	8Z-B6L J SS	1/2" Tube	1500	Standard Parker Instrument Ball Valve
SHT 5 OF 7	GN7024						SS w/ PTFE seats
	GN7027						\$160.00
	GN7028						Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	GN7010	Ball Valve w/ PTFE Trim	Parker	8V-B6L J SS	1/2" Tube		Parker Instrument Ball Valve w/ Vacuseal Fittings
SHT 5 OF 7							SS w/ PTFE seats \$240.00 Stock

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7006	Cryogenic Manual Block Valve	ACME	V-1060-100-S-J-5	1"		CVI line
SHT 2 OF 7	LN7015						Vacuum Jacketed
	LN7016						\$2,068
	LN7020						
	LN7021						
	LN7030						
	LN7031						
	LN7040						
	LN7041						
	LN7050						
	LN7051						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7003	Cryogenic Manual Block Valve	ACME	V-1060-150-S-J-5	1-1/2"		CVI line
SHT 2 OF 7							Vacuum Jacketed \$2,961

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7011	Cryogenic Air Operated Block Valve	ACME	V-1070-100-S-J-5	1"		CVI line
SHT 2 OF 7	LN7012						Vacuum Jacketed
	LN7013						\$5,344
	LN7014						Includes 2 FO Actuators
							Includes 2 FC Actuators
							Includes Open/Closed Limit Switches

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7018	Cryogenic LN2 Vent Valve	ACME	89-2542-00382 SPECIAL – Ultraseal	0.5"		Specify Vacuum Jacketed
SHT 2 0F 7	LN7023						\$2,800
	LN7033						Specify 1/2" Ultraseal inlet and outlet fittings.
	LN7043						
	LN7053						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	Quant. 4	Bayonets	PHPK	Standard Cryogenic	1"	150	Includes tie-in to existing house LN2 supply
SHT 2 0F 7	(not tagged)	Quantity estimated					Vacuum Jacketed \$643

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	Quant. 3	Bayonets	PHPK	Standard Cryogenic	1-1/2"		Includes tie-in to existing house supply
SHT 2 0F 7	(not tagged)	Quantity estimated					Vacuum Jacketed \$814

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7002	Relief Valves	Circle Seal	K520T1-6MP-100	3/4"	100 psig SP	Cryogenic rated, inline style
SHT 2 OF 7	LN7004						\$216
	LN7005						SS
	LN7007						
	LN7017						
	LN7022						
	LN7032						
	LN7042						
	LN7052						
	LN7001						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	No Tag	Vacuum Feedthrough	Pave	VS15L-SS-150-9P-TT20-48-48			Type "T" Thermocouple Feedthrough
SHT 2 0F 7	Assigned						\$300

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	7TC32	Omega Thermocouples for Cryobaffles	Omega	Bolt-on style, WTT-14-M-60	Type "T". Clip to chevron (not directly to LN2 tubing) near center of baffle.
SHT 2 OF 7	7TC33		Omega	Bolt-on style, WTT-14-M-60	Type "T". Clip to chevron (not directly to LN2 tubing) near center of baffle.
	7TC35		Omega	Bolt-on style, WTT-14-M-60	Type "T". Clip to chevron (not directly to LN2 tubing) near center of baffle.
	7TC36		Omega	Bolt-on style, WTT-14-M-60	Type "T". Clip to chevron (not directly to LN2 tubing) near center of baffle.
	7TC37		Omega	Bolt-on style, WTT-14-M-60	Type "T". Clip to chevron (not directly to LN2 tubing) near center of baffle.

Contractor Note:

Run leads from Omega Thermocouples mounted to cryobaffles to PAVE connector, routing the leads above the bottom nozzles on the sides of VF-7 through ~24" long discontinuous lengths of 1/4" SS tubing for protection. Tack weld clips to inside of VF-7 as needed to support the leads.

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	7TC38	Omega Thermocouple for LN2 vent line	Omega	Insertion, GTQSS-14G-6"	Type "T". Insert through Parker 4-4 FH4BZ tube to MPT thermocouple adapter, threaded into tapped opening on copper LN2 line, 48" upstream of KO pot, mounted vertically through top of pipe. Omega type SMPW-T-MF connector with type MRB rubber boot for weather protection. Use PTFE tape on threads of fitting.
SHT 2 0F 7	7TC45	Omega Thermocouple for knock-out pot	Omega	Insertion, GTQSS-14G-6"	Type "T". Insert through Parker 4-4 FH4BZ tube to MPT thermocouple adapter, threaded into tapped opening on KO pot, 2" below the overflow line, on side of pot (90 degrees to overflow). Omega type SMPW-T-MF connector with type MRB rubber boot for weather protection. Use PTFE tape on threads of fitting.
					\$90 (includes allocation for fittings)

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	LN7061	Cryobaffles	GNB	MCB-35	35"		GNB "Standard" Configuration, w/ Retention Clips
SHT 2 OF 7	LN7062 LN7064 LN7065 LN7066						specify Parker Ultraseal connections
			1	When ordering, include note that clips are required to allow the cryobaffles to be retained in position when the ODPs are removed for service. This is a standard, no extra charge option from the supplier allowing double nuts to be installed to hold the cryobaffles in place.			
			2	When ordering, specify 1/2" Parker Ultraseal fittings on the Cryobaffles. These are available at no extra cost (standard is Nupro VCR fittings)			
			3	Note that the copper tubing connections to the cryobaffles are somewhat flexible and can be			
			4	Connect the LN2 supply to the long tubing connection			
			5	Connect the LN2 return to the short tubing connection			
			6	Do not insulate the extension from the cryobaffle body. Insulate from the base of the copper tubing outward. Insulating the extension could lead to overcooling of part of the cryobaffle, causing distortion and inadequate vacuum sealing performance.			

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7PT3	Pressure Transmitter	Rosemount	2088G2S22A1			4-20 ma
SHT 2 OF 7							0-150 psig 316 SS Silicone diaphragm isolation fluid 1/2"-14 FPT Process Connection 1/2"-14 conduit Non-explosion proof See catalog cut for mounting options
							The impulse lead to transmitter MUST come off the top of the LN2 line. A vapor gap must be established to maintain the transmitter above its minimum operating temperature of -40 F, and to reduce heat leak into the LN2 system.

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Contractor Notes:

- 1 Contractor must demonstrate the operability of the vacuum system, including the roughing system and ODPs, prior to handover to the Government. This includes vacuum tightness of the system, based on ANSI E498-95, and proper operation of the cyrobaffles.
Responsibility for system pumping capacity and ultimate vacuum capability remains with NASA

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	RP-1	Mechanical Roughing Pump	BOC Edwards	Stokes 412J-14	GFE (purchased by NASA) to be integrated into existing 1722 Platform (existing structure, Roots Blower, Stokes Blower)
SHT 1 OF 7					<p>Requires Integration into 1722 System, including</p> <p>Restoration of Stokes system platform, Model 1722, including:</p> <ol style="list-style-type: none"> 1 disassembly & cleaning 2 replacement of gaskets, o-rings, v-belts, necessary fasteners and hardware 3 blower mounting 4 Microvac pump mounting 5 performance test for ultimate blower to pump blank-off pressure 6 complete refinish 7 prepare for shipment

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	BL1	Stokes Blower	BOC Edwards	Stokes 615-1			GFE, requires refurbishment. Part of Stokes 1722 Platform roughing system
SHT 1 OF 7							<p>Minimum refurbishment requirements:</p> <ol style="list-style-type: none"> 1. Teardown & Inspection 2. Splash Lube Seal Cover Conversion Kit, upgrade installation 3. Replacement of bearings, seals and elastomeric components. 4. New lubricant charge 5. Shop test for blank off pressure and proper operation. 6. Complete refinish. 7. Preparation of pump for shipping and interim storage until installed.

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	BL2	Roots Blower	Roots	Roots 16x39 RGS/HVB			GFE, requires refurbishment. Integrated into 1722 Platform by Stokes / BOC Edwards
SHT 1 0F 7							<p>Minimum refurbishment requirements:</p> <ol style="list-style-type: none"> 1. Cleaning 2. Inspection 3. Replacement of bearings, seals, gaskets, and elastomeric components, sight gages, oil filter, breather cap and gear locking assemblies. 5. Shop test for blank off pressure and proper operation. 6. Preparation of pump for shipping and interim storage until installed.

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	ODP1	Diffusion Pumps	Varian	NHS-35			GFE. Nominally Varian NHS-35 pumps, of two different vintages. Require refurbishment.
SHT 1 0F 7	ODP2						<p>Minimum Refurbishment Requirments:</p> <ol style="list-style-type: none"> 1. Disassembly, cleaning, inspection, and reassembly 2. Restoration of sealing surfaces, as req'd, for high vacuum service. 3. Replace o-rings and elastomeric components 4. Ensure that cooling connections and tubing are in good condition and unobstructed. 5. Proper securing of ODPs for interim storage until installed.
	ODP4						
	ODP5						
	ODP6						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7015	Air operated roughing vacuum valves			4"		GFE, in place on existing BL1 outlet
SHT 1 0F 7	V7001		GNB	G4PSOP	4"		New Valve, bypass around BL1 304SS electropneumatic actuators 110 V AC solenoid Magnetic position sensors Leak checked to 10-9 cc/sec He

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7002	Air operated vacuum valve	GNB	G8PSOP	8"		Bypass around BL2
SHT 1 OF 7							304SS electropneumatic actuators 110 V AC solenoid Magnetic position sensors Leak checked to 10-9 cc/sec He

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7005	Air operated roughing vacuum valve	GNB	RG6PSOP	6"		Roughing gate valves
SHT 1 0F 7	V7006 V7008 V7009 V7010						304SS electropneumatic actuators 110 V AC solenoid Magnetic position sensors Leak checked to 10-9 cc/sec He

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7003	Air operated roughing vacuum valve	GNB	G18PSOP	18"		Roughing gate valves
SHT 1 0F 7	V7004						304SS electropneumatic actuators 110 V AC solenoid Magnetic position sensors Leak checked to 10-9 cc/sec He

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7020	Manual vacuum isolation valves	MDC	320052	3/4"		Standard MDC small vacuum valve
SHT 1 0F 7	V7021						
	V7023						
	V7024						
	V7025						
	V7026						
	V7030						
	V7031						
	V7032						
	V7033						
	V7034						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	V7022	Manual vacuum isolation valves	MDC	320053	1"		Standard MDC small vacuum valve

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	7TC1	RP1 Mechanical Roughing Pump (Stokes) Oil Temp	Omega	Insertion, GTQSS-14G-6"	Type "T", INSERTION
SHT 1 0F 7	7TC2	BL1 Body	Omega	Insertion, GTQSS-14G-6"	Type "T", INSERTION
	7TC3	Roots Blower BL2 Oil	Omega	Insertion, GTQSS-14G-6"	Type "T", INSERTION
	7TC4	Roots Blower BL2 Body	Omega	Insertion, GTQSS-14G-6"	Type "T", INSERTION

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7PT1	Pressure Transmitters	Rosemount	2088A1S22A1		0-30 psia	Stokes roughing pump oil pressure is subatmospheric, requires absolute pressure readout.
SHT 1 0F 7	7PT2			2088G1S22A1		0-30 psig	Roots blower oil pressure is above atmospheric, requires gage readout. 4-20 ma 316 SS Silicone diaphragm isolation fluid 1/2"-14 FPT Process Connection 1/2"-14 conduit Non-explosion proof See catalog cut for mounting options

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
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CF-126231	7ROT1	Rotation Sensor	Maxigard	A1000			
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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	REMARKS
CF-126231	7CG1	Convectron Gages	Granville Phillips	275185		With Female 1/4" VCR
SHT 1 OF 7	7CG2					Mount horizontally
	7CG3					\$150
	7CG4					
	7CG6					
	7CG7					
	7CG8					
	7CG9					
	7CG10					
	7CG11					
	7CG12					

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7IG1	Ion Gage	Granville Phillips	274002			Mount horizontally
SHT 1 OF 7							\$115

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	SIZE	W.P.	REMARKS
CF-126231	7DPS1	Differential Pressure Switch	United Electric	J21K-127B	1/2" NPTF		\$256
SHT 1 0F 7	7DPS2						

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
CF-126231	7TC5	ODP Body	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
SHT 1 OF 7	7TC6	ODP Water	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC8	ODP Body	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC9	ODP Water	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC14	ODP Body	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC15	ODP Water	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC17	ODP Body	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC18	ODP Water	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC20	ODP Body	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE
	7TC21	ODP Water	Omega	SA1-T, with HGMP-T-MF connector pair, with SMCL safety clip.	Type "T", SURFACE

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
N.A.	SP7001 SP7002	Video Camera Installation	Panasonic	WV-CW864 (Remote) WV-CW474S (Fixed)	Includes two Panasonic B&W monitors WV-BM1410 One PTZ Panasonic Wall Mount PWM20G One Fixed PTZ Panasonic Wall Mount PWM474S One Power supply, 4 channel Bi-Tronics PW-PS2440S8 One PTZ Panasonic Control (Single Channel) WV-CU161C Cabling, misc. parts

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P&ID	TAG NO.	DESCRIPTION	MFR.	MODEL NO.	REMARKS
LabView Display / Control System					Quote estimate
		LabView base package software	National Instrument		\$995.00
		LabView Data Logging and Supervisory Control Module	National Instrument		\$1,995.00
		DS Data Server software	Automation Direct		\$300.00
		Ethernet Cable			\$50
		PC with MicroSoft XP / 2000 Operating system			\$4,350.00
					\$7,690.00